The Cost-effectiveness of Alcohol Screening, Brief Intervention, and Referral to Treatment (SBIRT) in Emergency and Outpatient Medical Settings

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Abstract:

Objective

This study analyzed the cost-effectiveness of delivering alcohol screening, brief intervention, and referral to treatment (SBIRT) in emergency departments (ED) when compared to outpatient medical settings.

Methods

A probabilistic decision analytic tree categorized patients into health states. Utility weights and social costs were assigned to each health state. Health outcome measures were the proportion of patients not drinking above threshold levels at follow-up, the proportion of patients transitioning from above threshold levels at baseline to abstinent or below threshold levels at follow-up, and the quality-adjusted life years (QALYs) gained. Expected costs under a provider perspective were the marginal costs of SBIRT, and under a societal perspective were the sum of SBIRT cost per patient and the change in social costs. Incremental cost-effectiveness ratios were computed.

Results

When considering provider costs only, compared to outpatient, SBIRT in ED cost $8.63 less, generated 0.005 more QALYs per patient, and resulted in 13.8% more patients drinking below threshold levels. Sensitivity analyses in which patients were assumed to receive a fixed number of treatment sessions that met clinical sites' guidelines made SBIRT more expensive in ED than outpatient; the ED remained more effective. In this sensitivity analysis, the ED was the most cost-effective setting if decision makers were willing to pay more than $1500 per QALY gained.

Conclusions

Alcohol SBIRT generates costs savings and improves health in both ED and outpatient settings. EDs provide better effectiveness at a lower cost and greater social cost reductions than outpatient.

Keywords: Alcohol | SBI | Cost-effectiveness | QALYs | Outpatient | Emergency department

Article:

1. Introduction

The physical, psychological, and social harms of substance abuse represent an important public health problem. The annual total estimated social cost of substance abuse in the United States is $510.8 billion (Miller & Hendrie, 2009). Screening, brief intervention, and referral for treatment (SBIRT) for alcohol has been shown to be clinically effective at identifying and ensuring treatment for people who consume above guidelines for low risk consumption but who would not be considered dependent (Heather, 1995 and Vasilaki et al., 2006). Referral to treatment helps address the treatment needs of people at the upper end of the risk continuum, including those dependent on alcohol.

Analyzing the cost-effectiveness of SBIRT in different medical settings is a timely topic. The integration of substance abuse services into general medical care is growing (Buck, 2011). In addition to the U.S. Substance Abuse and Mental Health Services Administration (SAMHSA), several other agencies have expressed the need to expand SBIRT services. The U.S. Preventive Services Task Force recommends that clinicians provide alcohol screening and brief intervention (SBI) to adult patients (Moyer, 2013). The Institute of Medicine, the Office of National Drug Control Policy, and the National Prevention Council have called for the integration of services designed to address substance misuse into primary care (Padwa et al., 2012). The American College of Surgeons Committee on Trauma requires that level I and II trauma centers screen for alcohol misuse, and level I trauma centers provide brief interventions (American College of Surgeons Committee on Trauma, 2007).

Extensive literature shows that alcohol SBI is effective in primary care settings, yet many SBIRT implementation efforts have been conducted in emergency departments (EDs). In light of the current budget constraints and limited health care resources, it is important to understand the costs and effects of SBIRT delivery in these two settings. Policy makers might have to prioritize SBIRT delivery in the most cost-effective setting, and to do this they need information on the relative value for money of implementing SBIRT in each setting.

While there is substantial literature on the costs and benefits of alcohol dependence treatment, there is a lack of economic studies focusing on alcohol SBI in medical settings (Kraemer, 2007). The lack of strong evidence for the cost-effectiveness of alcohol SBI is also mentioned in a recent cost-effectiveness review of SBI by Latimer, Guillaume, Goyder, Chilcott, and Payne (2010). In his review of economic studies of alcohol SBI in medical settings, Kraemer identified 15 studies; however, four of them were only partial economic evaluations (i.e., they were cost analyses that did not take the health outcomes of a program into account). These studies are useful for program planning but do not indicate whether health outcomes are worth the costs and cannot be used to help with the allocation of scarce resources. Most studies lacked methodological rigor, which is consistent with the findings reported in a review by Barbosa, Godfrey, and Parrott (2010). In addition, Kraemer (2007) only found two economic evaluations of alcohol SBI in EDs. To our knowledge, no study has compared cost and effectiveness across settings. An extensive literature suggests that alcohol SBI is effective in some medical settings, particularly primary care (Chick et al., 1988, Fleming et al., 1997a, Fleming et al., 2007, Gentilello et al., 2005, Gentilello et al., 1999, Marlatt et al., 1998 and Miller and Sovereign, 1989), but it may not always result in health care cost savings (Bray et al., 2011 and Latimer et al., 2010). Decision makers contemplating whether to implement SBIRT require guidance on what outcomes would be expected and what resources are required to achieve those outcomes. Cost-effectiveness analysis (CEA) quantifies the trade-off between costs and outcomes and uses nonmonetary measures of outcomes, such as drinking and quality of life. Thus, CEA helps decision makers by identifying strategies that represent good value for money (Drummond et al., 2005 and Gold et al., 1996), and interventions that should be reimbursed from collective funding (Taylor, Drummond, Salkeld, & Sullivan, 2004).

Since 2005, SAMHSA has funded six cohorts of grantees to implement SBIRT. Under this program, grantees screen and provide appropriate feedback, intervention or treatment to all individuals presenting for care, but not specifically seeking treatment for substance use, in selected medical settings, such as primary care clinics, trauma centers, and EDs. The current study presents the results of a CEA of the cross-site evaluation of the SBIRT initiative on the first cohort of seven grantees. Although administration varied across providers, typical procedures were as follows. The two common alcohol screening tools used were the Alcohol, Smoking and Substance Involvement Test (ASSIST) (Ali et al., 2002 and Humeniuk et al., 2010) and the Alcohol Use Disorders Identification Test (AUDIT) (Reinert and Allen, 2002 and Saunders et al., 1993), administered by a general practice nurse or behavioral health specialist. Brief interventions (BIs) were time-limited (15 min or less) and delivered using a motivational interviewing approach or other recognized method by a behavioral health specialist. Brief treatments (BTs) were scheduled counseling sessions with a behavioral health specialist. Referral to treatment (RT) was the act of making an appointment for specialist treatment, usually at another location.

The analysis compares SBIRT delivery in two common settings: ED and outpatient. ED includes emergency departments and trauma centers, and outpatient includes a variety of clinics, such as Federally Qualified Health Centers (publicly funded general health care facilities providing primary health care in low-income areas) or hospital outpatient clinics.

2. Methods

2.1. Overview

In CEA, the costs and consequences of at least two strategies (i.e., SBIRT delivery in outpatient and ED settings) are compared, and the results can help with understanding the value for money of each strategy (Drummond et al., 2005 and Gold et al., 1996). Health benefits associated with the strategies being compared can be measured and valued using natural units of outcome (e.g., reduction in risky alcohol consumption), or they can be measured and valued using generic measures of health-related quality of life, such as quality-adjusted life years (QALYs). QALYs incorporate the value individuals place on their health, called utilities, and are a widely used measure of health benefits that allows a comparison between different health care interventions that compete for the same pool of resources.

The CEA used a decision analytic tree model following a cohort simulation approach. Data were observational and administrative, supplemented by survey data and the literature. Alcohol consumption and costs were assessed at baseline and 6 months after baseline. Separate analyses were conducted for two analytic perspectives. The provider perspective includes the costs to those delivering services. The broader social perspective includes costs to society: health care utilization—including the provider of SBIRT, criminal activity, automobile accidents, and lost income. All phases were conducted with the approval of an institutional review board protecting human subjects' interests.

2.2. Population

The analysis considered 9835 SBIRT screen positive patients. The characteristics of the baseline population are presented in Table 1. Compared with the outpatient setting, the ED setting had statistically significantly higher mean age (37 vs. 31 years) and greater proportions of males (61% vs. 54%), alcohol users (75% vs. 62%), and users of alcohol and other substances (29% vs. 27%). To capture variations between the settings this study adopted a pragmatic naturalistic design and did not adjust for those differences.

Table 1.
Baseline characteristics by setting.

Characteristic	ED (n = 7658)[a]	Outpatient (n = 2177)[a]	*P*
Age, years (SD)	36.9 (13.5)	31.2(16.0)	0.000
Male (SD)	0.611(0.005)	0.543 (0.011)	0.000
Currently employed (SD)	0.366 (0.482)	0.384 (0.487)	0.415
Any alcohol use in the past 30 days (SD)	0.753 (0.431)	0.618 (0.486)	0.000
Any illicit drug use in the past 30 days (SD)	0.394 (0.489)	0.384 (0.49)	0.405
Using alcohol and illicit drugs in the past 30 days (SD)	0.292 (0.455)	0.269 (0.444)	0.04

Notes: The p-value reported for the test on age is from two-sample t-test with equal variance; and for the test on binary indicators is from a chi-squared test of homogeneity. SD = standard deviation.

[a] Maximum number of observations.

The current study focused on SBIRT for alcohol-related problems. However, the program also included SBIRT for other psychotropic substances. Among the baseline sample, 39% of patients consumed drugs in the past 30 days at baseline. Twenty nine percent consumed both drugs and alcohol, and about 74% of people using drugs also used alcohol. The study does not exclude individuals with drug consumption at baseline. As shown in Table 1, the number of baseline drug users in the two settings was balanced (p = 0.4).

2.3. Decision tree

Decision trees are simple models where patients' health states are clearly defined and time is not modeled explicitly. The model tracks the expected outcomes and costs of patients screening positive for drinking above the guidelines and receiving SBIRT services (Fig. 1).

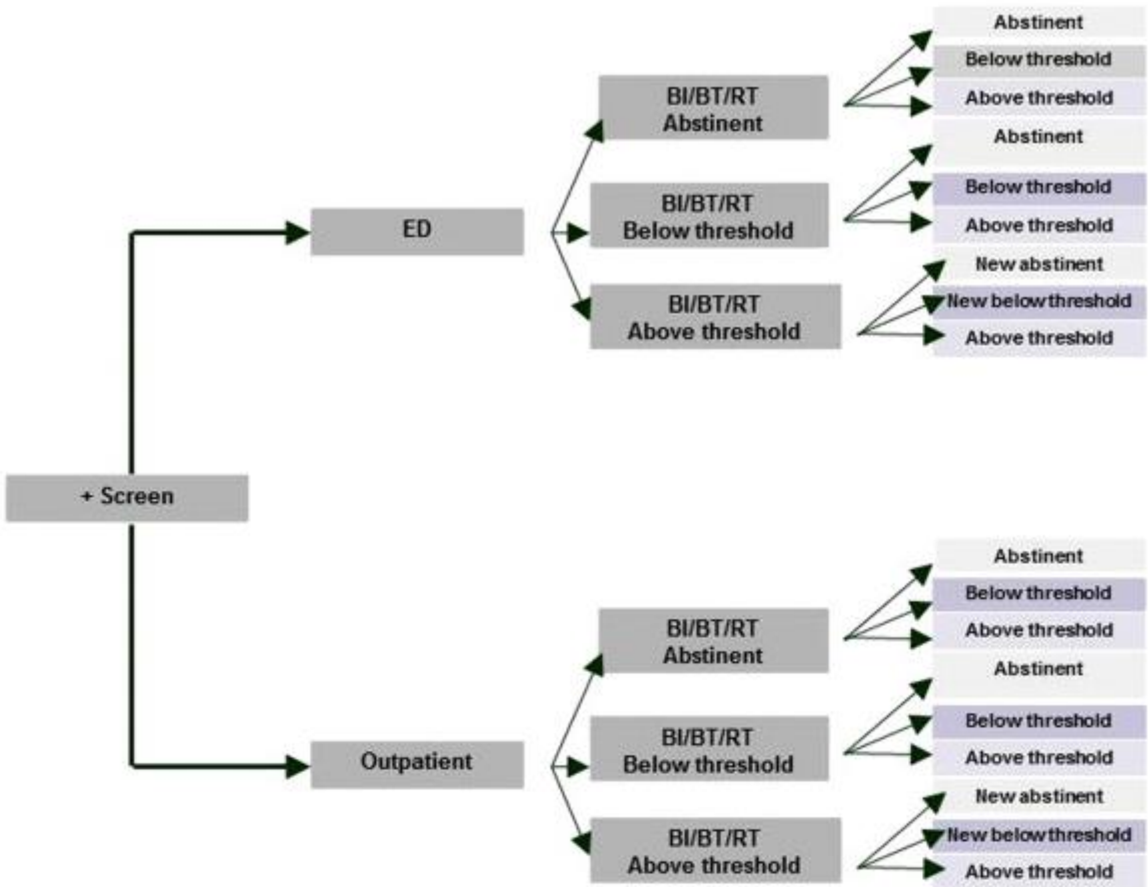

Fig. 1.

Decision tree model.

Note: BI = brief intervention, BT = brief treatment, RT = referral to treatment; threshold defined as drinking five or more drinks in one sitting or four or fewer drinks in one sitting and feeling high.

The health states, defined in the form of baseline and follow-up drinking categories, capture the effectiveness and cost-effectiveness of brief interventions in preventing unhealthy drinking and promoting low risk drinking levels, including abstinence. Each health state has associated utilities and social costs, as described below. SBIRT screen-positive patients in each setting were classified into three drinking categories: abstinent, below threshold, and above threshold. Abstinent refers to no consumption during the past 30 days, and threshold is defined as drinking five or more drinks in one sitting or four or fewer drinks in one sitting and feeling high in the past 30 days. Drinking above the threshold comprises people consuming at levels that pose some risk to health, including hazardous and harmful levels (e.g., Higgins-Biddle et al., 2009 and Humeniuk et al., 2010). Follow-up drinking categories are conditional on baseline drinking because previous drinking is associated with current health (Rehm et al., 2003). Patients that were in abstinent or low threshold states at follow-up and in above threshold state at baseline were classified as *new abstinent* and *new below threshold* at follow-up, respectively. The number of patients in each category at baseline and follow-up informed the transition probabilities between the different states, for each setting. These probabilities were used to calculate the number of patients in each state of the model.

2.4. Data

2.4.1. Health states

Health state measures were from the Government Performance and Results Act (GPRA) data (Service Accountability Improvement System, 2011). GPRA data were entered by program staff at baseline, 6-month follow-up, and discharge from the program as part of the requirements for receiving grant funds. These data provided information on baseline and follow-up drinking for each setting to capture the association between SBIRT and drinking behavior and classify patients into the health states of the model, which in turn informed the effectiveness component of the CEA. The GPRA lacked information on the quantity of drinks and information that would allow gender-specific drinking states to be calculated. GPRA includes items regarding the number of days during the past 30 that patients used any alcohol and the amount of times patients consumed five or more drinks in one sitting or four or fewer drinks in one sitting and felt high. The number of patients in each category at baseline and follow-up, by setting, was informed by intake and 6-month follow-up GPRA data, respectively.

2.4.2. Health state utilities

QALYs incorporate changes in quality of life (morbidity) by using a set of values or weights called utilities, one for each possible health state, which reflect the relative desirability of the health state (Drummond et al., 2005). The conventional scale for utility values used to calculate QALYs ranges from 0 (death) to 1 (perfect health). The relative desirability of outcomes is measured using the von Neumann–Morgenstern utility theory (von Neumann & Morgenstern, 1944), where utilities are measured under uncertainty, such as in the standard gamble approach (Holloway, 1979). Utilities can also be measured under certainty using a choice-based approach, such as the time-trade-off (Torrance, Thomas, & Sackett, 1972). To our knowledge, only two studies have used a revealed-preferences approach to measure utilities for different health states that describe the spectrum of levels of alcohol consumption (Kraemer et al., 2005 and Petrie et al., 2008).

Utility values for each of the five health states of the model were derived from a study of the utility of different drinking states for a U.S. population that used the standard gamble technique from a clinic/community sample (Kraemer et al., 2005). The mean utility values (standard deviation) used for each state were: abstinent 0.93 (0.15), new abstinent 0.83 (0.24), below threshold 0.88 (0.22), new below threshold 0.85 (0.26), and above threshold 0.75 (0.29). Abstinent has the highest utility score, followed by below threshold. Above threshold has the lowest utility. New abstainers and below threshold drinkers that were drinking above threshold at baseline have lower utilities than those who were abstinent or below threshold at baseline. In addition, new abstainers have a lower utility than new below threshold drinkers, which can be because those who abstain now had more problems in the past and so still have lower utility, or/and reduced drinking is a better outcome than abstinence. The finding that those with more serious past problems had a lower utility than those with less serious past problems is consistent with the only other study that reported utility levels for different levels of alcohol consumption (Petrie et al., 2008).

2.4.3. Social costs

To collect data on social costs events (e.g., nights in jail) for the 6 months before and 6 months after SBIRT services, the research team conducted a separate survey of a subsample of patients (Bray et al., 2007). The 6-month time frame captures relatively rare events (e.g., automobile accidents) and matches the time frame of the GPRA data. A random sample of sites was drawn using probability proportionate to size sampling, so that larger sites had a higher probability of being selected. The survey provided 2210 unique baseline interviews, of which 865 were positive screens and thus used in the current study. Survey records were weighted to make results representative of the patients exposed to SBIRT. In a first stage, patients were weighted to the full sample of patients from each specific setting. In a second stage, site-level patient flows were weighted up to the grantee level. There were 1258 weighted observations used to calculate socials costs by drinking category.

Health care utilization was measured by the number of times patients received ED and outpatient treatment for a physical complaint or a behavioral (substance abuse/mental health) problem. Criminal justice costs were measured by the number of arrests and nights incarcerated. Automobile accidents were measured by the number of car crashes. A monetary valuation of the social outcomes was assigned by multiplying the unit costs of each outcome by the frequency of events. Unit costs with the exception of wages were retrieved from the peer-reviewed literature. ED cost estimates for physical and behavioral problems came from French and Martin (1996), outpatient costs for behavioral problems came from Roebuck, French, and McLellan (2003), arrest costs came from Zarkin, Dunlap, Hicks, and Mamo (2005), incarceration costs came from Stephan (2004), and automobile accident costs came from Blincoe et al. (2002) The unit cost calculation for an episode of driving under the influence of alcohol was based on several sources (FARS, National Highway Traffic Safety Administration, 2007 and Miller et al., 1996). Absence from work used patient’s self-reported annual income and the number of hours worked during the previous week (estimated directly from the patient survey). The overall change in social costs after SBIRT delivery was calculated for each drinking state and is presented in Table 2. Social costs changes were attached to the health states and differ between settings as a result of different distribution of patients between the health states.

Table 2.
Social costs change by drinking category.

Drinking Category	n	Mean $ (SD)[a]
Abstinent	500	− 390.24 (9278.62)
Below threshold	412	− 1491.72 (1934.79)
Above threshold	258	1877.01(25,007.54)
New abstinent	24	− 738.17 (15,911.80)
New below threshold	64	− 9526.92 (32,1181.72)

[a] Values are average numbers standard deviations (SD), collected with patient survey. Negative values represent a social cost reduction; high standard deviations incorporated in probabilistic sensitivity analysis; threshold defined as drinking five or more drinks in one sitting or four or fewer drinks in one sitting and feeling high; 2011 prices in US $.

2.4.4. SBIRT costs

SBIRT treatment costs were defined as the marginal costs of each SBIRT component (screening, BI, BT, and RT) for the ED and outpatient settings (Bray et al., 2014). During observational site visits to a sample of SBIRT sites, trained evaluators observed practitioner–patient interactions and recorded the time required to provide each SBIRT component. Observers timed 110 screenings, 45 BIs, 11 BTs, and 12 RTs. Activities were categorized as direct service delivery, support of direct services (e.g., record keeping, reading the patient's chart, or locating the patient), or SAMHSA grant-related activity (e.g., collecting federally mandated performance monitoring data). Grant-related activities were not included in the cost estimates because they are not a cost of SBIRT per se. To estimate hourly wage rates, job titles and qualifications of practitioners were matched with positions in the Bureau of Labor Statistics database (Bureau of Labor Statistics, 2009) to obtain the national average wage for each position. Wages were multiplied by an estimated overhead and benefits multiplier of 1.2733 (27.33% of wages). The median wage within setting was used as a standardized unit cost for labor. The hourly rate for a square foot of space was calculated from the national average Class A rental space rate from a national real estate analysis firm (Grubb & Ellis Realty Advisors Inc., 2007). Labor costs of each SBIRT component were calculated by multiplying the mean time required for direct service delivery and support of direct services with the standardized wages. Space costs were calculated by multiplying time required for each service and the rental rate per square foot per minute. The unit cost of each SBIRT component was calculated by summing of labor and space costs. The unit cost for each component of SBIRT was then multiplied by the actual number of sessions that each patient received, as indicated by the GPRA discharge data, and an average cost of SBIRT per patient was estimated for each setting (Table 3).

Table 3.
SBIRT costs by setting.

SBIRT costs	Emergency Department (n = 7658)	Outpatient (n = 2177)
Mean number of sessions[a] (SD)	Screening: 1 (0)	Screening: 1 (0)
	BI: 0.64 (0.48)	BI: 0.90 (0.87)
	BT: 0.18 (1.40)	BT: 0.54 (1.73)
	RT: 0.03 (0.18)	RT: 0.04 (0.19)
Average unit cost ($) of each session	Screening: 4.24	Screening:2.71
	BI: 6.03	BI: 8.11
	BT: 24.94	BT: 20.48
	RT: 8.61	RT[c]: 8.61
Average cost ($) of SBIRT per patient[b] (SD)	12.81 (32.70)	21.45 (33.06)

Notes: SD = standard deviation; n = number; BI = brief intervention; BT = brief treatment; RT = referral to treatment; 2011 prices in $US.

[a] All patients received one screening; number of sessions taken from Government Performance and Results Act (GPRA) data.

[b] The average cost per patient was calculated with patient-level GPRA data, and therefore it is not exactly the sum of the product of the average number of sessions and the average cost of each component by setting.

[c] The cost of RT for the outpatient setting was assumed to be the same as for the ED setting due to lack of data.

2.5. Health outcomes

Based on the number of patients in each health state, three expected health outcomes were calculated. The first effectiveness outcome was the proportion of patients with a good outcome, which is defined as not drinking above threshold at follow-up, and hence being in any of the four other health states (abstinent, below threshold, new abstinent, and new below threshold). This was calculated by dividing the difference between the number of patients with good outcome at follow-up and baseline by the number of patients with a good outcome at baseline. The second effectiveness outcome was the proportion of patients who improve to below threshold, which is defined as a transition from above threshold at baseline to an abstinent or below threshold state at follow-up. This was calculated by dividing the difference between the number of patients in the above threshold state at baseline and follow-up by the number of patients in the above threshold state at baseline. The third health outcome was the QALYs gained, which was the difference between follow-up and baseline QALYs.

2.6. Cost-effectiveness analysis

In the CEA, both settings were assessed for dominance (e.g., both more effective and less costly) by ranking settings by cost and determining differences in effectiveness. In the absence of one setting dominating, an incremental cost-effectiveness ratio (ICER) was computed to estimate the additional cost required to achieve one additional unit of outcome. The ICER is the difference in costs (C) divided by the difference in mean effectiveness (E), $(C_j - C_i)/(E_j - E_i)$, for strategies j and i. In the current study, the best setting is the most effective setting with an ICER that is not more than the decision maker's intrinsic valuation for an additional unit of the outcome (Drummond et al., 2005 and Gold et al., 1996). No consensus has been reached on decision makers' willingness to pay in the United States, although a $50,000/QALY benchmark has been used in several studies (Grosse, 2008).

Expected costs from a provider perspective were the marginal costs of SBIRT, and from a societal perspective were the sum of the costs of SBIRT per patient and the change in social costs after SBIRT delivery by drinking state.

2.7. Sensitivity analysis

Probabilistic sensitivity analysis was conducted to incorporate uncertainty in model parameters. The quality and quantity of information available were reflected in probability distributions assigned to each parameter input in the model where a more diffuse distribution represented a higher level of uncertainty in the estimate. Dirichlet, beta, gamma, and normal distributions were assigned to the transition probabilities between drinking states, health state utilities, costs of SBIRT, and change in social costs parameters, respectively. Monte Carlo simulation was used to calculate the combined impact of the model's various uncertainties (Doubilet, Begg, Weinstein, P, & McNeil, 1985). When ICERs were computed, uncertainty in the model was described using a cost-effectiveness acceptability curve (CEAC) to graphically show the probability that one setting is more cost-effective than the other based on decision makers' willingness to pay for an additional QALY (Briggs et al., 2006 and Drummond et al., 2005).

Two sensitivity analyses were conducted to estimate the impact of changing certain parameters on base-case results.

In the first sensitivity analysis, the perspective on costs was the SBIRT payer perspective. The SBI Common Procedure and Terminology (CPT) codes (99408, 99409) were used to place a monetary value in SBIRT services. The CPT code 99408 reimburses $33.41 for alcohol and/or substance abuse structured screening and brief intervention services lasting 15 to 30 min. The CPT code 99409 reimburses $65.51 for alcohol and/or substance abuse structured screening and brief intervention services greater than 30 min. This does not provide information on the breakdown of costs used in the base-case analysis. Therefore, we applied CPT code 99408 to screening and BI, and CPT code 99409 to BT. The same value as in the base-case analysis was used for RT ($8.61). Under this scenario, the marginal SBIRT cost per patient was $33.43 in the ED setting and $65.79 in the outpatient setting.

A second sensitivity analysis assumed a similar number of sessions for each component of SBIRT in the two settings. This approach assumed six BI sessions, 12 BT sessions, and one RT session for those patients for whom each service was recommended at baseline as a result of screening. The number of sessions used was an average of the maximum number of sessions specified in each site protocol. This number is not intended to reflect clinical guidance and is very specific to the SBIRT programs evaluated. Under this scenario, the marginal SBIRT cost per patient was $94.16 (SD 103.85) in the ED setting and $86.30 (SD 73.92) in the outpatient setting.

3. Results

3.1. Base case results

The baseline distribution of positive screen patients presenting to the ED setting was 25% abstinent, 18% below threshold, and 57% above threshold; the distribution for the outpatient setting was 31% abstinent, 14% below threshold, and 54% above threshold. The base-case analysis of 1000 simulations shows that both SBIRT and social costs were lower in the ED setting than in the outpatient setting; the majority of the cost savings were societal cost savings (Table 4). Delivering SBIRT in an ED setting costs $8.63 less than in an outpatient setting, mainly because fewer sessions of BI, and especially BT, were actually delivered in EDs than outpatient settings, as previously shown in Table 3. Mean net cost savings for the ED and outpatient settings were $531.74 and $217.95, respectively. In terms of effectiveness measures, 13.8% more patients in the ED setting than the outpatient setting were drinking below threshold levels or were abstinent at follow-up. Also, 3.5% more patients in the ED setting than the outpatient setting improved their drinking from above threshold levels at baseline to below threshold levels or abstinence at follow-up. The greater estimate for the association with drinking in the ED setting generated 0.005 more QALY than in the outpatient setting (see Table 4). One possible factor contributing to the greater improvements in drinking and QALYs in the ED setting is that patients presenting to the ED setting had a lower quality of life than those presenting to the outpatient setting (0.815 in ED vs. 0.831 in outpatient), which gives a higher potential for improvement from SBIRT services. Overall, for both a provider and social perspective, SBIRT in the ED setting dominates the outpatient setting, and an ICER need not be calculated.

Table 4.
Base-case results per patient (probabilistic results from 1000 simulations).

Base-case results	Emergency Department (ED)	Outpatient	ED − Outpatient
SBIRT costs ($, 2011 prices)	12.81	21.44	− 8.63
Social cost change ($, 2011 prices)	− 544.55	− 239.39	− 305.16
SBIRT + social costs ($, 2011 prices)	− 531.74	− 217.95	− 313.79
Baseline QALYs	0.815	0.831	-0.015
Follow-up QALYs	0.828	0.839	-0.011
QALYs gained	0.013	0.008	0.005
Good outcome[a]	0.443	0.305	0.138
Improve to low risk[b]	0.327	0.292	0.035

Notes: For the base-case analysis, the ED setting costs less and is associated with better patient outcomes than the outpatient setting. Therefore, ED dominates outpatient, and an ICER is not computed. QALY = quality-adjusted life year; SBIRT = screening, brief intervention, and referral to treatment.

[a] Proportion not drinking above threshold at follow-up (threshold defined as drinking five or more drinks ir one sitting or four or fewer drinks in one sitting and feeling high).

[b] Proportion of patients who improve to below threshold, defined as a transition from above threshold at baseline to a abstinent or below threshold at follow-up.

3.2. Sensitivity analysis

Two sensitivity analyses varied assumptions on the unit costs of SBIRT services and on the number of sessions delivered. When CPT codes were used, the ED setting dominated the outpatient setting for all outcome measures. Even though the cost per patient increased, SBIRT costs remained higher in the outpatient setting than in the ED setting, because of the higher number of services actually received in the outpatient setting. Therefore, the results of the base-case analysis were robust to the use of CPT reimbursement codes.

In the second sensitivity analysis, assuming the maximum recommended number of BI, BT, and RT sessions under a provider perspective, resulted in the ED setting being not just more effective but also more expensive. An ICER was computed, and the uncertainty on the overall distribution of costs and effects is represented in a CEAC (Fig. 2). The CEAC shows that when the decision maker is not willing to pay more than about $1500 per QALY gained, the less expensive setting (outpatient) is more cost-effective. As the decision maker is willing to pay more, and therefore health gains are more highly valued, the probability that the ED setting is cost-effective increases. For threshold values higher than around $4000, there is high certainty that the ED setting is the most cost-effective. This is a very low value considering the $50,000/QALY benchmark used by decision-makers to determine which intervention represents good value for money.

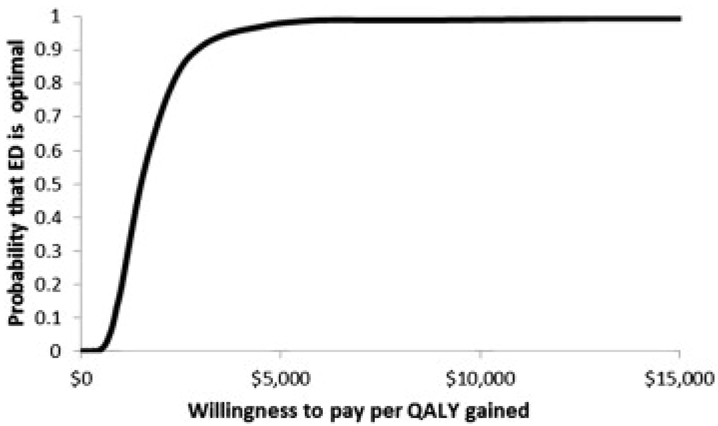

Fig. 2.

Acceptability curve: probability that ED setting is more cost-effective than outpatient, maximum recommended number of sessions scenario.

Note: ED = emergency department; QALY = quality-adjusted life year.

Under a societal perspective in the second sensitivity analysis, the ED setting dominated the outpatient setting. As was found in the base-case analysis, in this case, overall costs were lower and effectiveness was higher in the ED setting than in the outpatient setting. SBIRT costs in the ED setting were higher because this setting had a larger proportion of patients drinking above threshold levels and these patients required more expensive services (like BT). However, overall costs were lower because higher service costs were offset by lower social costs.

4. Discussion

This study conducted the first cost-effectiveness analysis comparing SBIRT in ED to SBIRT in outpatient settings. We found that delivering SBIRT in an ED setting is potentially effective and more cost-effective than the outpatient setting for all simulations of the base-case analysis. Consistent with previous studies (Mortimer and Segal, 2005, Saitz et al., 2006 and Solberg et al., 2008), it was estimated that additional QALYs could be gained at low cost through screening plus BI (or/and BT) in either setting. It was also shown that when social costs are included, both settings led to net cost savings with the ED being less costly. The QALYs gained in both settings (0.013 in ED and 0.008 in outpatient) are slightly below ranges reported elsewhere (Mortimer and Segal, 2005, Saitz et al., 2006 and Solberg et al., 2008). However, the findings may not be directly comparable, largely because of differences in study periods (short- or long-term analysis), modeling methods, intensity and frequency of service, and overall study design (observational or randomized). Although the current study found that SBIRT was more cost-effective in the ED than in the outpatient setting, the finding does not necessarily imply that SBIRT should only be implemented in EDs. If decision makers' preferences and budget allow, the results suggest implementing SBIRT in both settings.

In one sensitivity we replaced the number of SBIRT sessions actually received by the average number of sessions that grantees had planned to offer. It would seem reasonable to assume that with more sessions delivered patients' outcomes would also improve. However, there is no evidence that a higher number of sessions is related to statistically significant better outcomes

(Kaner et al., 2007). While increasing the number of sessions reflected grantees delivery protocol, changing the effectiveness of the intervention, equally or differently in both settings, would be speculative.

One characteristic that patients presenting to the ED and outpatient settings had in common was screening positive for consuming alcohol above recommended levels. However, as expected, patients in each setting differed in demographics and, most importantly, in baseline alcohol consumption. This study adopted a pragmatic naturalistic design to capture this variation. Adjusting for these differences, to make the patient populations more similar and circumvent heterogeneity, would have driven us away from the main objective of the study: comparing the delivery of the same intervention – SBIRT – in different settings that naturally serve different populations. Our approach maintains the real-world characteristics of the settings and the main purpose of the analysis to answer a relevant policy question.

Despite the advantages of a pragmatic naturalistic design, the non-experimental nature of the study has the standard disadvantages of observational studies. These include possible regression to the mean and selection bias. Relying on pre–post comparisons without a control group cannot rule out the possibility that changes observed are driven by regression to the mean or other uncontrolled factors rather than the influence attributed to SBIRT. In addition, unobserved heterogeneity in the form of setting variation may in part determine the results that suggest that ED is more cost-effective in the base case analysis. To some extent, all grantees implemented evidence-based practices and a common approach to SBIRT. For example, all grantees used evidence-based screening tools to screen for at-risk alcohol use and for the same screening instrument all used the instrument's scoring "zones" of level of alcohol use to determine the appropriate SBIRT component (e.g., BI vs. BT). However, aside from measurement errors, there might have been unobservable factors influencing assignment that were not only related to patients' substance use (e.g., grantee culture). There were also variations between grantees in terms of the screening instrument used and the type of professional delivering each component of SBIRT. Our analysis did not account for those variations which might have an impact on both the costs and effects of SBI.

The alternative to using observational data, however, is to randomize patients to settings. This would likely create an artificial treatment environment as patients could not be feasibly assigned to one setting or the other, in part because of the reasons they visit one setting or the other. An experimental study would not answer an important question from a public health point of view: in which setting is it more cost-effective to deliver SBIRT: the ED or the outpatient setting? If decision makers need to decide in which setting they should invest scarce health resources, it might be the heterogeneity between settings that justifies delivering SBIRT in one setting rather the other.

The analysis faces at least three limitations that have implications for future research. First, even though self-report of alcohol use is accurate when collected carefully (Babor et al., 2000 and Del Boca and Noll, 2000), as in our study, it remains a concern that social desirability bias could have overestimated the benefits of SBIRT. In addition, the measures of drinking – which determine the current study health states – do not perfectly align with accepted drinking guidelines (NIAAA, 2005). Drinking below the risk threshold in the data does not necessarily convey a risk-free drinking level. A finer measure would be needed to disentangle low-risk and risky drinking below the current threshold. Nevertheless, the drinking states defined match the measures used by SAMHSA, the largest funder of non-research SBIRT programs in the United States, to monitor program performance. Second, data on implementation fidelity in the two settings were not systematically collected. Therefore, we cannot assess how faithfully each setting adhered to SBIRT practices. Third, the study used utilities taken from the peer-reviewed literature. Although the utility estimates were based on a U.S. population using well-established methods, the weights might not be applicable to SBIRT patients. Future research with greater study resources should explore administering a quality of life questionnaire and determining U.S. social values to value SBIRT patients' health states.

In addition to addressing the above limitations, future studies should attempt to replicate the findings with other data and build on the research in other ways. An important avenue for future research is to understand the long-term cost-effectiveness of SBIRT. Whereas treatment costs are incurred immediately, important benefits, such as maintained reductions in chronic disease, are realized in the long term (Barbosa, Godfrey and Parrott, 2010 and Barbosa, Taylor, et al., 2010). However, limited information is available on the long-term effectiveness of brief alcohol interventions (Jonas et al., 2012, Latimer et al., 2010 and Moyer et al., 2002). Two studies followed patients for up to 48 months post-intervention (Fleming et al., 1997b, Fleming et al., 2002, Ockene et al., 1999 and Ockene et al., 2009) and showed modest short-term effects that faded over time. Other effectiveness studies show that SBI in outpatient settings is superior to SBI in ED settings, in terms of both drinking outcomes and the persistence of those outcomes at follow-ups beyond 6 months (Havard et al., 2008, Nilsen et al., 2008 and Schmidt et al., 2014). This suggests that, compared with ED settings, outpatient SBIRT may be more cost-effective in the long-term. However, without long-term data, this cannot be assessed. To date, no study has followed SBI patients for their lifetime, meaning that the long-term effectiveness and cost-effectiveness of SBI can only be assessed with a modeling framework that extends the approach taken in the current study.

Another area for further research is assessing whether screening and BI only would be a preferred approach in ED settings, and whether BT should only be offered in a less busy outpatient setting. To analyze the effectiveness of the delivery of a different intervention – SBI with and without BT – in two different settings, a future study will need to include an intervention group (SBI with BT) and a control group (SBI only) within each setting.

Finally, the SBIRT payer perspective used in the second sensitivity analysis considers separable budgets for specific health care services, including screening and treatment of behavioral health conditions. To adopt a broader health care payer perspective other costs, such as inpatient costs, would need to be collected. Further studies should attempt to collect all costs relevant to a payer perspective.

Despite its limitations, this paper makes several contributions to the literature on SBI. It presents cost and effectiveness data of alcohol SBI in real-world outpatient and ED settings. In contrast, most economic evaluations of alcohol SBI have been conducted in a research primary care setting (Kraemer, 2007). It also adds to the scarce number of economic evaluations of alcohol SBI and the even more scarce number of such evaluations reporting QALYs as an outcome measure. Rather than relying on drinking or other outcomes alone, this study incorporates health-related quality of life. Also, by accounting for statistical uncertainty, the analysis avoids the unrealistic assumption that the costs and effects are deterministic in nature. Presenting results from both the provider and social perspectives means that results may be useful both to decision makers with a narrower, provider focus and to governmental policy makers, who have a broader constituency. Finally, by comparing the ED and outpatient settings, the study makes a timely contribution to the burgeoning field of comparative effectiveness research. This field of research is very much a response to the need to understand how to allocate resources across delivery settings in the face of health care reform in the United States.

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